the illustrative engravings, convey but indistinct ideas of the subjects to which they refer. D. F. C.

Art. XII.—*Principles of Human Physiology, with their chief applications to Pathology, Hygiène, and Forensic Medicine. Especially designed for the use of Students. With over one hundred illustrations.* By William B. Carpenter, M. D. &c. First American edition, with additions by the author, and notes and additions, by Meredith Clymer, M. D., &c.: 8vo. pp. 618. Philadelphia: Lea & Blanchard, 1843.

The rapid multiplication of treatises on physiology, within a few years past, is an unquestionable evidence of the increased attention which the science has received of late, more especially on the part of the medical profession, and of its acknowledged importance as the only foundation upon which can be built a correct theory nf the nature and causes of the morbid changes that occur in the functions and organization of the human body. How far "the making of many books" is calculated to increase our acquaintance with the true principles of physiology is a question with which we have at present nothing to do, our only duty, as reviewers, being to examine into the merits of the several treatises as they successively appear. New works on physiolngy would, however, seem to be more frequently demanded than upon almnst any other of the natural sciences. Its cultivators commenced to theorize long before they learned to observe, and hence every new accession of facts, or of supposed facts, was made the excuse for the erection of a new theory, which was scarcely announced before it required to be modified by the results of more recent discoveries—and even now, the rapid progress of the science, and the numbers actively engaged in its cultivation, demands, that at short intervals, a careful collation should be made of the established facts with the conclusions based upon them; while improvements in the arrangement of the materials already in our possession, and in the manner of teaching the principles of the science unquestionably call also for repeated new publications in relation to it.

The work of Dr. Carpenter is among the latest that has appeared; and though its pretensions are less than many of those that have immediately preceded it, it appears to us to be well calculated to communicate to the student clear and accurate views of the principles and leading facts of human physiology. It is "sufficiently elevated in character" to represent the present condition of the science—"sufficiently compendious" for the limited time at the disposal of most students, and "sufficiently practical in its tendency" to lead its readers to the useful application of the facts and principles it places before them.

We fully agree with the author that the present treatise presents a very fair digest of the latest and most satisfactory information on the subject of which it treats. His endeavour has evidently been "to bring together the valuable facts and principles, scattered through the best of the numerous monographs, that have recently been published on special divisions of physiology and medicine; and to reduce these *disjecta membra* to that

systematic form, which they can only be made rightly to assume when brought into relation to each other, and shown to be subservient to principles of still higher generality." In these endeavours, the author has certainly been very successful—and hence the work is not to be viewed as a mere compilation from preceding treatises, but rather as an original digest of the established facts and principles of physiological science.

The author lays claim to some degree of originality in regard to many of the facts and deductions contained in the volume before us—but especially in relation to the views he has expressed with respect to the relations of instinct and intelligence, and to the location of the former in the ganglia of special sensation;—and to those which relate to the respective functions of fibrin, albumen, and gelatin, as well as to other subjects treated of in the chapter on nutrition. The value of Dr. Carpenter's views on these several points must be tested by future observations.

Our intention, on the present occasion, is not to enter into an examination of the accuracy of the facts or of the various deductions advanced in the treatise of Dr. Carpenter—but rather, to give to our readers some idea of the general character of the work, and of its adaptedness to indoctrinate the student into the principles of human physiology.

The volume is divided into fourteen chapters, which treat respectively of the place of man in the scale of being—of the functions generally, and then of the functions of the nervous system—of sensation and the organs of the senses; of muscular contractility; of voice and speech; influence of the nervous system on the organic functions; of digestion and nutritive absorption; of the circulation; of respiration; of nutrition and of secretion. Then follows a general review of the nutritive process, and the volume closes with an account of reproduction.

On the propriety of this arrangement, which appears to us particularly defective, it is perhaps unnecessary to offer any comment. So intimately connected is each of the systems of organs entering into the composition of the human frame with nearly all the others, that there is some difficulty, in investigating their functions, to determine which it is the most proper and convenient to begin with.

The volume commences with some very sensible remarks upon the connection of physiology with other branches of medicine. The remarks, however, are only general in their character—their applicability to particular cases is developed, as the different vital functions are respectively examined.

The first chapter—embracing the distinction between animals and plants, the general subdivisions of the animal kingdom, with the general characters of each division; of the subdivisions of the vertebrata, and of the subdivisions of the mammalia class of the vertebrata with a general view of their characteristics, forms a very useful and philosophical introduction to the study of the special physiology of the human being.

This latter is introduced by a general view of the vital functions. We quote from this chapter the following passage, in which a position is laid down of much importance in pathology, and although every day becoming more and more fully recognized, is nevertheless not unfrequently still entirely lost sight of, in reasoning upon the nature and character of disease, and the proper therapeutical measures for its removal.

"The activity of a living being, being dependent upon two sets of conditions, the organized structure which it possesses, and the stimuli to which this is ex-

pnsed, we can scarcely separate from our notion of an organized structure, that of the peculiar properties which it possesses; for we never see an organized structure remaining as such, unless it possess some degree of vitality. It may be said, that, when an animal or plant is killed by a strong electric shock, its organization is unaffected, yet its vital properties are destroyed. Yet no proof of such an operation, which is contrary to all analogy, has ever been afforded. In no other circumstances do we ever witness the departure of vitality, without some change of structure or of composition which can be made evident. In the ordinary *death* of an animal, we may commonly trace the actinn of the morbific cause upon some particular organ, whose function is thereby either suspended or perverted; and the cessation of the whole train of actions necessarily results, if this organ be one of those essentially concerned in them. Thus, to take a not uncommon case, a patient with tubercular deposition, nearly filling both lungs, becomes the subject of an ulceration, which suddenly opens a passage from one of the bronchiæ to the pleural cavity on one side; death from this cause is frequently almost instantaneous, from the total incapacity of the other lung to maintain by itself those respiratory actions, which are necessary to the continuance of the circulation. Take again, for example, the influence of a narcotic poison; it occasions torpidity, first of the brain, and then of the medulla oblongata. So long as its action is confined to the brain, the general train of vital operations is no more disturbed than it is in profound sleep; but as soon as it affects the medulla oblongata, the respiratory movements become paralyzed (from causes to be hereafter explained) and the circulation is soon brought to a stand; and every organ in the body speedily loses its characteristic properties, by the commencement of chemical changes in its composition. But, if the respiration be artificially sustained, the circulation will continue, and all the processes of nutrition, secretion, &c. to which it is subservient, will be performed with little interruption. Hence, the cessation of the whole train, which would otherwise ensue, and the loss of vitality of the general structure, are due to the local change produced by the morbific cause; and the same may be traced, although not always so evidently, in a variety of other instances."

The remarks made by Dr. Carpenter on the dependence of the operations of mind upon the size and condition of its material instruments, though concise, are particularly pertinent and conclusive. In fact, the whole of this chapter is replete with interest, and affords one of the best general views of the vital functions of the human organism we are acquainted with, and is admirably adapted to prepare the way for their separate and more minute study.

The author's account of the elementary structure and functions of the nervous system, is extremely clear, and corresponds with the results of the latest observations. The section devoted to the comparative anatomy and physiology of the nervous system, is one of a highly interesting character, and cannot be too attentively studied, affording as it does important data for the elucidation of the functions of the nervous system in man.

A very full account is given of the nervous system of the vertebrata. The observations of the author upon the functions of the spinal cord will be found to throw considerable light upon certainly, to the student at least, one of the most complex and difficult parts of physiology.

"The influence of the spinal cord and of its system of nerves, on the movements of respiration, affords an excellent example of the importance of this organ as supplying the conditions immediately requisite for the maintenance of the organic functions. We have seen that, strictly speaking, the act of respiration, as we commonly understand it, is not respiration itself; for, *this* consists in the interchange of ingredients between the blood and the surrounding medium, which is effected in the air cells of the lungs, and which takes place in the lower animals (as in plants) without any muscular effort. But in proportion to the necessity for the energetic exercise of this function, do we find a special

provision in the higher classes for the constant renewal of that portion of the surrounding medium, which is in contact with the aerating surface; and this comes to be so necessary, that asphyxia might be produced, without any interruption to the ingress of air through the trachea, by merely breaking the circle of nervous action through which the movements of respiration are effected. It is an interesting circumstance, however, which shows the provision made in the animal frame to meet its necessities; that a very small portion only of the nervous centres is involved in the action; and that, even in the highest animals, all the rest may be removed, or may be rendered functionally inactive without checking it. This fact, which was ascertained by Legallois, harmonizes well with that which comparative anatomy has brought under our notice; for it has been shown that, in the lowest group of mollosca, but a single ganglion exists; and that this is almost exclusively concerned in regulating the entrance and exit of the currents of water, the most constant office of which is the aeration of the blood."

The influence of the spinal cord in respect to the functions of deglutition and defecation are clearly explained, and with a brief consideration of the protective agency, generally, of the spinal cord, closes the account of its reflex action. The whole is calculated to give to the student a very clear idea of a function of the nervous system, for our knowledge of which we are entirely indebted to the labours of modern and very recent observers. Some judicious remarks are made at the close of the several sections devoted to the examination of this function, upon the leading pathological doctrines which have been developed in it.

The comparative anatomy of the encephalon introduces the reader to the history of its functions; commencing with those of the cephalic nerves. The physiology of the nerves of the sense of smelling, seeing and hearing is given with the author's usual clearness. In regard to the sense of taste, Dr. Carpenter concludes that both the glosso-pharyngeal nerve and the lingual branch of the fifth pair are concerned in it.

"Considering," he remarks, "how nearly allied is the sense of taste to that of touch, and bearing in mind the respective distribution of these two nerves, it does not seem difficult to arrive at the conclusion, that both nerves are concerned in this function; but there seems good reason to believe the glosso-pharyngeal to be exclusively that through which the impressions made by disagreeable substances taken into the mouth are propagated to the medulla oblongata, so as to produce nausea, and to excite efforts to vomit."

An interesting inquiry follows in relation to the much disputed subject, the functions of the par vagum. In regard to its trunk, the author remarks, it must be considered as a nerve of double endowments, conveying to the medulla oblongata the impression produced by venous blood in the capillaries of the lungs, or of carbonic acid in the air cells; which impression may give rise to the respiratory movements, without producing sensation; but, if it be from any cause stronger than usual, the sense of uncasiness which it occasions is very distressing. "Besides the pulmonary impressions, this nerve also conveys to the medulla oblongata those which originate in the mucous surface of the larynx, trachea, and bronchi, as well as those on the lower part of the œsophagus, and on the walls of the stomach. The purpose of these is to stimulate various movements which are performed through the motor portion of the trunk; this excites the actions of the muscles of the pharynx and larynx, of the œsophagus, and in some degree, of the stomach and respiratory tubes."

The influence of a section of both of these nerves upon respiration, is shown to arise from the diminished frequency of the respiratory movements, preventing a sufficient quantity of air being introduced into the

lungs for the due aeration of the blood; and this, according to an established principle in physiology, suspends to a certain extent the circulation of blood in the pulmonary capillaries.

"The congestion of the vessels, induced by insufficient aeration, satisfactorily accounts, not only for the effusion of serum, but also for the tendency to pass into the inflammatory condition sometimes presented by the lungs, as by other organs similarly affected."

Hence, although these nerves are not immediately concerned in the special function of the lungs, they indirectly contribute to its regular and perfect performance. These views are almost exclusively founded upon the very interesting experiments and observations of Dr. Reid.

It appears to be settled by the experiments of Dr. Reid, that the secretion of gastric juice is not, as asserted by Wilson Philip, and subsequent experimenters, dependent on nervous influence supplied by the par vagum, though doubtless in part regulated by it; a position which we advanced and attempted to prove as early as 1818. Neither does it appear that the muscular motions of the stomach are entirely dependent on, though probably in some degree influenced by the par vagum. The entire offices of the nerve, so far as the stomach is concerned, have not as yet, however, been satisfactorily determined. Its influence over the actions of the heart is still involved in obscurity.

In treating of the motor nerves of the orbit, Dr. Carpenter notices the action of the muscles inserted into the ball of the eye. The proper action of the superior oblique, which has been a matter of some dispute, he considers to be to draw the pupil downwards, and a little outwards. This theory of its action, which would be inferred from the manner in which its tendon is inserted, is borne out by experiments both upon the muscle and the nerve which supplies it.

The functions of the encephalon come next under consideration. The author commences this division of his subject with a most interesting inquiry into the special function of the ganglionic enlargements at the upper end of the medulla oblongata; which, with the tracts of gray matter, he considers as subservient to the instinctive actions that are prompted by sensation, but in which there is no indication of volition; and hence that in every nervous trunk there exists at least three sets of fibres, one for reflex actions, another for the instinctive and emotional, and a third for volition. There seems much probability in the suggestions of the author, which are in harmony with what we know of the physiological constitution, so to speak, of the nervous system, and removes some difficulties which have always stood in the way of a satisfactory explanation of the psychical endowments of many of the lower order of animals, and the instinctive actions of man.

In regard to the functions of the cerebellum, Dr. Carpenter appears inclined to adopt the views of Flourens and others, as well as, to a certain extent, those of the phrenological school. After a very fair and impartial view of the experiments and pathological facts adduced in support of the opinion which attributes to the cerebellum the office solely of regulator of the motor function, and the arguments adduced, on the other hand, to prove that it is entirely devoted to the sexual instinct; Dr. Carpenter concludes as follows:—

"The author is far from denying *in toto* that any peculiar connection exists between the cerebellum and the genital system; but if the evidence at present

adduced in support of the phrenological position be held sufficient to establish it, in defiance of so many opposing considerations, we must bid adieu to all safe reasoning in physiology. The weight of testimony appears to him to be quite decided in regard to the connection of the cerebellum with the regulation of the motor function. How far this invalidates the *moderate* phrenological view, which does not regard the function of the cerebellum as *exclusively* devoted to the sexual instinct, is a question well deserving of attention. There is nothing opposed to such an idea in the results of the experiments already adverted to; since there is no evidence that sexual instinct remained after the removal of the cerebellum; but, on the other hand, there is no proof that it was destroyed. A circumstance which has been several times mentioned to him, that great application to gymnastic exercises diminishes for a time the sexual vigour, and even totally suspends desire; seems worthy of consideration in reference to such a view. If the cerebellum be really connected with both kinds of functions, it does not seem unreasonable, that the excessive employment of it upon one should diminish its energy in regard to the other. Further, it would seem by no means improbable, that *the lobes* are specially connected with *the regulation and co-ordination of movements;* whilst *the vermiform processes*, which are very large in many animals in which the former scarcely present themselves, are the parts concerned in the *sexual function*. As an additional argument in favour of the former part of this view, it may be stated, that in man the lobes bear a larger proportion to the vermiform processes than in any other animal; and that they undergo their most rapid development during the first few years of life, when a large number of complex voluntary movements are being learned by experience, and associated by means of the muscular sensations accompanying them; whilst in those animals which have, immediately after birth, the power of regulating their voluntary movements, for definite objects, with the greatest precision, the cerebellum is more fully developed at the time of birth. In both instances it is well formed, and in active operation, so far as can be judged by the amount of circulation through it, long before the sexual instinct manifests itself in any perceptible degree."

The functions of the cerebrum are next considered. Dr. Carpenter inquires first, what may be considered as firmly established in relation to its offices. Which is, that it is the sole instrument of *intelligence*, by which term is implied, the voluntary adaptation of means to ends, in a manner implying a perception of the nature of both:—that it is the organ through which all those impressions are received, which give rise to *voluntary* actions, and that it affords the power of occasioning muscular contraction in obedience to the influence of the will. It is probably the sole organ that ideas of notions of surrounding objects are acquired, and that it is by it these ideas are made the groundwork of mental operations. It would seem, also, to be the exclusive seat of memory.

The remarks of Dr. Carpenter upon the cerebral functions, are marked throughout by all that philosophical candour and caution which are so essential to arriving at correct conclusions on subjects, which, like that of the proper office of the cerebrum, have been and are still the subject of considerable diversity of opinion, and in relation to which hypotheses the most opposite have been advanced, with great confidence, by the most distinguished physiologists. The author appears to favour the idea of the brain being a congeries of organs, each appropriated to a distinct function, but is not prepared to adopt, as certainly correct, the location of these organs adopted by phrenologists; nor as positively established all the general principles which they have advanced.

"Without," he remarks, "wishing to set himself up as an opponent to phrenology, he perfectly agrees with Dr. Holland in thinking, that an impartial view of it requires 'not that the doctrine should be put aside altogether, but that great

abatement should be made of its pretensions as a system.' In particular, he thinks that those who pursue it are bound to make themselves first acquainted with what can be established as the general functions of the brain, before descending to particulars."

The following tabular view is presented of the nervous centres.

	CEREBRAL GANGLIA, the centres of the operations of *intelligence and will.*	
NERVES of *special sensation.*—*Motor fibres* mingled with general motor system.	GANGLIA OF SPECIAL SENSE, the centres of *consensual, instinctive,* and *emotional actions.*	NERVES of *special sensation.*—*Motor fibres* mingled with general motor system.
	CEREBELLIC GANGLIA, for *harmonization* of *general muscular actions.*	
Afferent and *Motor* NERVES of *Respiration, Deglutition,* &c.	RESPIRATORY and STOMATO-GASTRIC GANGLIA.	*Afferent* and *Motor* NERVES of *Respiration, Deglutition,* &c.
TRONKS of SPINAL NERVES, composed of fibres from true Spinal Cord, and from Cerebrum, Cerebellum, and Medulla Oblongata; each group containing afferent and efferent fibres.	Fibrous structure, continuous with Brain. *True* SPINAL CORD, consisting of chain of ganglia, for *Reflex actions* of the *trunk* and *extremities.* Fibrous Structure, continuous with Brain.	TRUNKS of SPINAL NERVES, composed of fibres from true Spinal Cord, and from Cerebrum, Cerebellum, and Medulla Oblongata; each group containing afferent and efferent fibres.

The whole of the author's remarks on the functions of these several nervous centres are marked by great clearness, and we believe are calculated to lead the student to a more correct general knowledge of the complex structure of the nervous system, than he can acquire from any other source. With the correctness of many of the deductions of Dr. Carpenter we are not prepared to agree. There are few of them, however, that are not marked with great probability, and the whole are advanced with a degree of candour, which we are persuaded, will command for them a more close examination than if they had been asserted with a greater degree of dogmatism. To every well established fact in connection with the subject he has given all the attention and all the prominence it deserves.

Chapter four, the several sections of which are devoted to a consideration of sensation in general, and to the organs of the special senses, touch, taste, smell, vision, and hearing, is one of the most satisfactory in the whole volume. Every physiological fact and well established principle in relation to each sense is fairly stated, and in that clear and explicit manner, so essential to the successful teaching of scientific subjects generally.

The subject of muscular contractility, according to the arrangement adopted by the author, is the next in order. The minute structure of muscle is examined with considerable care, and that of man compared with those of the lower animals, especially of the vertebrata. The subject, intricate in itself, is rendered more easy of comprehension by numerous pictoral illustrations. The proper physiology of the muscles is treated with the author's usual precision; well established facts and deductions are clearly stated, and all hypothetical disquisitions carefully avoided.

The true theory of voice, according to Dr. Carpenter may be now considered as fully established, in regard at least to this essential particular—that the *sound*, namely, is the result of the vibrations of the vocal ligaments, which take place according to the same laws with those of metallic or other elastic tongues; and that the pitch of the notes is chiefly governed by the tension of these laminæ. With respect, however, to the modifications produced in the tones by the shape of the air passages, both above and below the larynx; by the force of the blast, and by other concurrent circumstances, little is certainly known.

The whole subject is very ably treated, the author following chiefly the views contained in the paper of Mr. Willis in the Transactions of the Cambridge Philosophical Society, and the fourth book of Müller's Physiology. Of the physiology of articulate sounds, a very short account is given, but perhaps sufficiently long to give to the student an idea of the few leading facts known in relation to it. The subject of vocal sounds in general, whether in reference to language or music, is legitimately within the province of physiology, though altogether out of place in an elementary treatise.

The influence of the nervous system on the organic functions is a subject of great interest, and one upon which there exists a very considerable diversity of opinion. Of the dependence of the muscles of organic life upon nervous influence there can exist but little doubt, and of the latter being concerned, either immediately or remotely, in providing the conditions under which alone the organic functions can be performed, is unquestionably an established physiological fact; but in what manner, or to how great an extent, the functions of circulation, respiration, digestion, nutrition and secretion are dependent upon nervous influence may be considered as questions still undecided.

The views of Dr. Carpenter in relation to the sympathetic system of nerves, which are the special nerves of the organic functions, are mainly identical with those advocated by Müller. That the sympathetic nerves namely, are composed of cerebro-spinal filaments, and a system of gray fibres, which, in all probability, have an immediate action upon the molecular changes which constitute the functions of nutrition, secretion, &c.

"It is only necessary," the author remarks, "to soppose that the white fibres of the sympathetic nerve terminate in the true spinal cord, (which is not itself a centre of sensation), without proceeding to the brain, to have an explanation of the absence of sensory endowments in the organs to which they are distributed, and of the complete removal of the muscles supplied by their motor nerves, from voluntary control. That a few fibres, of which the actions cannot be excited under ordinary circumstances, pass on to the brain, would seem probable, from the fact of the sensibility of some parts in disease, which are totally insensible in their normal condition."

In regard to the supposed sympathetic action of the so termed sympathetic nerve, Dr. Carpenter observes:—

"It appears, that it may he stated as a general proposition, that all the evident movements which can be excited by irritation, applied to one part of the body, in the contractile organs or tissues of another, are really affected through the true spinal cord, whether the contractile organ be a powerful muscle, or a thin and feeble layer of fibres around a blood-vessel or duct. Upon the reasons why the fibres of the visceral nerves should be so peculiarly separated from the rest, we can at present only speculate; but it may not be considered improbable that, by their peculiar plexiform arrangement in the various ganglia through which they pass, connections are established between remote organs, which tend to bring their actions into closer relation with each other than would otherwise be the case. The existence of such connections, for the purpose of harmonizing the several movements of the viscera which are concerned in the various and complex operations of digestion and its attendant processes, may be inferred from the perfect conformity which exists between them, during all their different states of regular action; and still more, perhaps, from the phenomena of their disordered conditions."

Dr. Carpenter considers that we have no valid reason to believe that any of the processes of nutrition and secretion are dependent upon any kind or degree of nervous agency. These processes, he remarks, go on with great rapidity and energy in the vegetable kingdom, in which nothing approaching to a nervous system exists, and in the animal kingdom they take place with equal vigour long before the least vestige of it appears. Moreover, there is abundant evidence that secretion may take place after the death of the general system, through the persistence of certain molecular changes, of which the essential conditions are not immediately altered; and the growth of the beard, which has also been occasionally observed, indicates that even nutrition may continue to a certain degree.

The author, however, admits as indisputable, that many of the organic functions *are directly influenced* by the nervous system; but that this influence, exerted sometimes in exciting, sometimes in checking, and sometimes in otherwise modifying them, is rather a directing or controlling influence than one essential to the performance of the functions referred to, and "may well be compared to that which the hand and heel of the rider have upon his horse, or the engine driver exerts over a locomotive."

This controlling or directing influence of the nervous system upon certain of the organic functions is examined in detail—as it is exerted in depressing or exciting their action.

The consideration of the organic functions commences with those of digestion and absorption. Upon the first of these subjects the more recent facts and deductions will be found very fully and clearly detailed. The author assumes the purely chemical views advanced by the more recent physiologists, which are unquestionably correct so far as they go—but that digestion, whether in the stomach or intestines, is solely performed by chemical agency, is a doctrine which appears to us to want additional facts for its confirmation. The general conclusions of the author are:—

"1. That, by the operation of the gastric fluid, the azotized principles of the food, whether animal or vegetable, are dissolved in the stomach, and are converted into albumen. 2. That the saccharine principles undergo a further change in the duodenum, by which they are partly converted into albumen, and partly into oleaginous matter; and that they are absorbed by the lacteals of the intestines in one of these two states. 3. That the oleaginous principles are either converted into albumen, or are absorbed without alteration. 4. That—with the exception of certain mineral substances—matters which cannot be reduced to either of these forms, are rejected as excrementitious."

In regard to lacteal absorption Dr. Carpenter adopts a view which we

advanced and attempted to establish upwards of twenty-five years ago, namely, that the lacteals have in some degree the power of *selecting* the particles of which the chyle is composed; and that, whilst they take up such a proportion of each class of alimentary materials, as will rightly blend with the rest in the nutritious fluid, they reject not only the remainder, but also—for the most part at least—any other ingredients which may be contained in the fluid of the intestines.

"Such may be stated as the general result of the experiments that have been made to determine their function; though it is unquestionable, that extraneous substances, especially of a saline nature, occasionally find their way into this system of vessels. This may not improbably be due to a correspondence in the size and form of the ultimate particles of such substances, with those of the materials normally absorbed by the lacteals. Experiments upon the function of absorption in plants, whose radical vessels have a corresponding power of *selection*, appear likely to assist in elucidating this interesting subject. By the experiments of Dr. Daubeny it has been ascertained, that if a plant absorb any particular saline compound, it can also be made to absorb those which are *isomorphous* with it, though it will reject most others."

We are pleased to find the author giving his sanction to the opinion that the lymph, like the chyle, is a nutritious fluid, and not of an excrementitious character, as was formerly supposed. There is an evident conformity in the nature of the two fluids, with this exception, that the chyle contains a much larger *proportion* of assimilable substances—albumen, fibrin and fatty matter; the nature and amount of the less clearly defined animal principles, and of the saline ingredients, appear to be nearly identical in both.

"Hence it can scarcely be doubted that, to use Dr. Prout's expression 'a sort of digestion is carried on in all parts of the body.' That a part of the products of interstitial decomposition may be subsequently assimilated appears indisputable; for in no other way can we account for the fact, that animals may live for a time on their own solids. This is particularly evident in the case of hybernating animals, which retire to their winter quarters loaded with fat, and come forth quite lean in the spring; and in such cases we must believe, not only that the lymphatics select from the products of spontaneous decomposition those which are fit to be again assimilated, but that an actual change is effected in the fatty matter, by means of some action of the fluids upon it, which prepares it to be thus absorbed."

Many years ago we advanced precisely the same views, which were then received with not a little ridicule.

Some highly interesting, and very important facts and conclusions are contained in the section which treats of the supply of food required by man. In the correctness of a few of the conclusions we do not, however, entirely coincide. The subject of diet, as well in regard to the kind as to the amount of food necessary for the support of the health and vigour of man, is a somewhat complex one; as the circumstances of climate, nature and amount of occupation, habit, temperament, and state of health must all be taken into consideration in order to arrive at a correct conclusion, whereas by too many of the writers who treat of it, it is considered only in one point of view, and an attempt has even been made to determine a quality and amount of diet invariably adapted for the animal man. There are, unquestionably, certain general principles, connected with this subject, which are tolerably well settled, and are almost universally applicable, but details can be settled only by a reference to individual cases.

In treating of the subject of the circulation, the author denies that there is any ground for the assumption that the *capillaries* form a distinct set of

vessels in which the arteries terminate and the veins arise; or that they are in any respect different, except in size, from the other vessels. He also calls in question the correctness of the supposition, that nutrition can only be carried on by means of capillary vessels—it appearing from the late researches of Mr. Toynbee, that cartilages in general, the cornea, crystalline lens, and vitreous humour, together with the epidermoid appendages, are entirely destitute of them.

A very able section is given in relation to the action of the heart. On the important and much disputed question, the causes, namely, which influence the circulation in the arteries and capillaries, the views advanced by the author are ingenious, and borne out by striking analogies drawn from the physiology of vegetables and the lower classes of animals. He favours the idea of the independent circulation, at least to a certain extent, of the capillary vessels, or, in other words, that "the capillaries possess a *distributive* power over the blood, regulating the local circulation, independently of the central organ, in obedience to the necessities of each part." (*Palmer*) The whole of this section is deserving of a very close examination. The whole chapter on the circulation is a very able one. The same remark may be made in reference to the ensuing chapter, on respiration, the account of which function is full and clear, and the several views advanced in relation to it are in strict accordance with recent observations and experiments.

The chapter on nutrition is a highly important one. Until very recently everything in relation to the physiology of nutrition was little better than mere vague conjecture; but few well ascertained facts had been developed in relation to it, and upon these were erected hypotheses which promised much, but explained nothing. To the researches of contemporary physiologists we are, however, indebted for many important discoveries in regard to the ultimate structure of the solids, and the organizable principles of the blood, which throw very considerable light upon the manner in which the various structures of the animal frame are built up, and unorganized converted into organized matter.

In the several sections of the chapter before us devoted to a consideration of the organizable principles of the blood, the formation of cells, the elaboration of chyle and lymph, the physical and vital properties of the blood, the pathological changes in the blood, and the origin and formation of the solid tissues, the student will acquire a very correct idea of all the facts connected with the subject of nutrition—and the general deductions to which they lead. The whole chapter demands a very close study, in order to a full comprehension of the various points involved in the investigation of the nature and mode of the ultimate structure of organized matter. We had marked several paragraphs expressing the particular views of Dr. Carpenter, for extraction; but found that in order to render them perfectly intelligible, and to do full justice to the author and to our readers, those extracts would necessarily be more extensive than would be compatible with our limits—we must content ourselves, therefore, with merely recommending the chapter to the attention of such as desire to become acquainted with a subject, than which to the physiologist, and pathologist, there is none more replete with interest—none calculated, in its ultimate developments, to lead to more important results in reference to the more obscure laws of human biology.

Intimately connected with the subject of nutrition is that of secretion,

which is next considered—including under the general term, that of secretion proper, or the separation from the blood of certain of its constituents to subserve particular objects by their retention within the system, and excretion or the separation of certain substances from the blood, the retention of which would be positively injurious.

We quote the following sentence as well as a specimen of the author's manner of treating the subject, as from its containing within a small compass a very clear exposition of the nature of every secreting organ throughout the animal economy.

"Of the reason why certain compounds forming part of the circulating blood, are separated from it by one organ, and others by a different one, nothing whatever is known; and there is nothing in the evident structure of those organs that can afford any clue to the attainment of such knowledge. When their ultimate structure is considered, it is found to be neither more nor less than a vascular membrane; made up into various forms for convenience of packing. Of such a membrane, in its most expanded state, that which composes the walls of the serous cavities, or of the synovial capsules, affords a good example; and the fluid which these cavities contain is secreted by it. Of mucous membrane the structure is in some instances almost equally simple; but in general the secreting surface is extended into a large number of little open sacs or follicles, which are copiously supplied with blood-vessels, and are equally concerned with the external superficies, in the elaboration of the protective secretion that covers those membranes. In the most complex form of gland, we find nothing but a very obvious modification of this structure. Either the sacs are prolonged in cœca or blind tubes, as is the case in the human kidney and testis; or they are very greatly multiplied, and are clustered together—just like currants upon a stalk—upon efferent ducts common to several of them, as is seen in the parotid. Now that the particular modification of structure which the gland may present, has no essential connection with the character of the secretion it is destined to form, is evident from this circumstance,—that almost every gland may be found under a variety of forms, in different parts of the animal series."

Dr. Carpenter adopts the more generally received opinion; an opinion borne out by the recent experiments of Kiernan; that the bile is secreted entirely from the blood of the portal veins. Of the use of the bile, the author considers the most probable opinion to be, that besides its agency as a precipitant in separating the nutritious from the useless portion of the chyme, it is destined to remove from the blood its superfluous hydro-carbon, whether this has been absorbed as such from the aliment, or has been taken up by the blood as effete matter, during the course of the circulation. The presence of azote in picromel, however, shows that some of the effete azotized compounds also are got rid of in this manner.

In regard to the urinary secretion Dr. Carpenter believes that, there can be no doubt its chief purpose is to remove from the system the effete azotized matters which the blood takes up in the course of the circulation, or which may have been produced by the changes occurring in itself. This appears to be evident, from the large proportion of nitrogen, which is contained in the solid matter dissolved in it, and from the crystalline form presented by this solid matter when separated,—a form which indicates that its state of combination is such as to prevent it from conducing to the nutrition of the system.

The subject of the several secretions and excretions is treated with the author's usual ability. The structure of the various glands and glandular organs is minutely detailed—the chemical composition of the secreted and excreted fluids is given according to the latest and most authentic analyses,

and the general physiology of the whole subject very clearly elucidated. At the close of the chapter the author notices the various bodies, as the spleen, supra-renal capsules, and the thymus, and thyroid glands, which from their having a somewhat glandular aspect, are usually ranked among the secreting organs; but which have neither excretory ducts, nor any thing that can be considered as truly glandular in their structure. Upon the real office performed by these bodies, nothing certain is known; from the various conjectures as to their uses in the animal economy, Dr. Carpenter adopts what appears to him to be most probable. The theory of the operation of the spleen, the most satisfactory in his opinion is that advanced by Dr. Rush, which regards it as a sort of diverticulum or reservoir, which may serve to relieve the portal system from undue distension, under a great variety of circumstances. As to the supra-renal capsules, he considers that the only use that can be assigned to them, with any probability, is that of serving as a means of conveying into the veins the blood transmitted through the renal artery, when from any cause the secreting function of the kidneys is partially or entirely destroyed, and their capillary circulation in consequence stagnated. It would be easy to test the correctness of this supposition by the results of pathological anatomy. The author, although he admits that, at present, the question of the specific use of the thymus body must be left in uncertainty, seems favourable to the notion of Mr. Tyson, that the office of the thymus is to receive during fœtal life the blood which is afterwards sent to the lungs—a certainly not very probable idea, more particularly, as, according to the author's own admission, the body continues to grow after birth, and remains of considerable size during the first year. After the latter period, in common with the generally received opinion, Dr. C. remarks, "it gradually diminishes, and wholly disappears about the time of puberty." We have reason to believe that this disappearance does not generally take place; we have certainly observed the gland of very considerable size in the adult, and if credit is to be given to the statements of Krause, this is very generally the case; he declares that he has found it in almost all individuals between twenty and thirty years; and very often *larger* than in young children,—and he has seen it of considerable size between the ages of thirty and fifty. In the early part of adult life it is generally divided into two parts, as in the fœtus; these commonly adhere by cellular tissue. The lower cornua never, as in children, descend to the upper part of the pericardium, but frequently very low down upon the neck. He gives the following as the admeasurement of the thymus gland in some very healthy and well made individuals who had committed suicide:

In a male 25 years old, it was 34 lines long; 18.25 broad, 4 thick, weighing 292.5 grs; in volume 0.977 cubic inches, and in specific gravity 1.0352.

In a male 25 years old, it was 42 lines long; 32 broad, 2.3 thick, weighing 380.3 grs.; in volume 1.156 cubic inches, and in specific gravity 1.0311.

In a male 20 years old, it was in weight 356.5 grs.; in volume 1.085 cubic inches, and in specific gravity 1.0309.

In a female 28 years old, it was 22 lines long; 16 broad, 2 thick, weighing 69.2 grs.; in volume 0.211, and in specific gravity 1.0267.

Dr. Roberts of New York gives the result of the examination of the thymus at birth in six full grown children—the length varied from 12 to

nearly 36 lines; the breadth from 12 to 30 lines; the thickness from 5 to 6 lines, and its weight from 80 to 360 grs. The uses of the thyroid are not even conjectured.

The subject of animal heat is next considered. The views adopted by the author, in relation to the manner in which the temperature of the human body is produced and maintained are those that appear to be most in accordance with the best established facts, and the various vital phenomena both in health and disease.

The volume concludes with the consideration of the function of reproduction—the facts in relation to which are examined with great minuteness and care. The author adopts the doctrine of fecundation being the result of the action upon the female ova of the spermatozoa of the male semen, which find their way through the fallopian tubes to the ovaries.

We have now closed a very superficial notice of the valuable work of Dr. Carpenter. It contains one of the best summaries of the Principles of Human Physiology that has yet appeared. The author has taken particular care to discriminate between the doubtful and positive facts, and hypothetical and legitimate conclusions, in reference to every subject embraced in the science of which he treats—while, at the same time, he has endeavoured to assign to each fact and inference its due importance in the establishment of general physiological doctrines. To the student it will form a valuable manual; particularly to the student of medicine, the pathological applications of the various physiological facts and principles being in most cases indicated with considerable judgment. The leading characteristics of the present treatise were pointed out in the commencement of this notice. Dr. Carpenter has a very happy facility of making each subject of which he treats perfectly clear and comprehensible—showing, in all cases, the direct application of the facts he relates, and, admitting their truth, the probable or positive inference that results from them; a most important recommendation in every work prepared for the use of students. A somewhat different arrangement of the subjects would probably have been preferable to that adopted, but this is after all mere matter of opinion. The text is illustrated by pictoral diagrams wherever this mode of illustration could with propriety be adopted.

The additions of the editor, Dr. Clymer, are numerous and invariably pertinent—adding to the text of the author whatever has been derived from the daily improvements in physiology, and to his positions new illustrations. Dr. Clymer, at the request of the author, has incorporated in this edition, the able report of the latter on the physiology of cells, published in the British and Foreign Medical Review for January, 1843.

To such of the members of our profession who desire to become acquainted with the present state of physiology generally, or upon any particular subject, but cannot spare the time to consult the various monographs that have appeared within a few years, the present volume is recommended as well adapted to afford them the requisite information.

D. F. C.